

Implementation of Extreme STOL Capability in Cruise Efficient Aircraft, Phase I

Completed Technology Project (2007 - 2008)



Project Introduction

Aerotonomy, Incorporated and the Georgia Tech Research Institute (GTRI), will develop enabling technologies for an aircraft that is capable of Extreme Short Takeoff and Landing (ESTOL), while retaining efficient transonic cruise performance, by applying a comprehensive, systems-based design and analysis approach to innovative combinations of active flow control methodologies. The development of this technology directly supports the four strategic goals of NASA's Next Generation Air Transportation System (NGATS), namely 1) increased capacity, 2) improved safety and reliability, 3) increased efficiency and performance, and 4) reduced energy consumption and environmental impact. Individual circulation control technologies have been explored over the years, and have been demonstrated to provide highly effective force and moment augmentation and improved control capabilities. However, previous investigations generally did not focus on combining these CC systems into a cohesive and functional aircraft subsystem, nor did they examine CC impacts on other aircraft subsystems or overall integration issues. The primary innovation in the proposed project will be an optimal Combined Circulation Control (C3) system that maximizes net CC performance benefits over all flight phases, determined through a comprehensive set of systems-impact trades, including examinations of impacts on power requirements, propulsion system performance, noise characteristics, cost, reliability and aircraft weight.

Anticipated Benefits

This technology has potential applications in commercial airliners, business jets, and regional transports. In general, equipping these aircraft with cruise-efficient high-lift devices can enhance airport options, give the user more valid runway choices at existing airports, and help alleviate the noise problem near airports by allowing steeper climb-outs and approaches. Manufacturers of these aircraft include Boeing, Gulfstream, and Cessna, among others. There are many obvious military applications of the proposed technology. Some of these include ESTOL cargo and troop transport aircraft and shipboard aircraft, including the Navy UCAV. Super-circulation can be an enabling technology for launching and recovering medium and large UAVs from short and unprepared fields, without requiring specialized launch and recovery equipment and without incurring large cruise performance penalties due to conventional high lift systems. The technology proposed herein directly supports all four of NASA's Next Generation Air Transportation System (NGATS) strategic goals, namely: 1) increased capacity, 2) improved safety and reliability, 3) increased efficiency and performance, and 4) reduced energy consumption and environmental impact. Also, Panel B (Propulsion and Power) of the NASA funded National Research Council (NRC) Decadal Survey on Civil Aeronautics recommended ESTOL capability as a way of addressing the NGATS goals. The technology developed in this project will have application to ESTOL-capable small transport aircraft with efficient transonic cruise capabilities, thereby



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

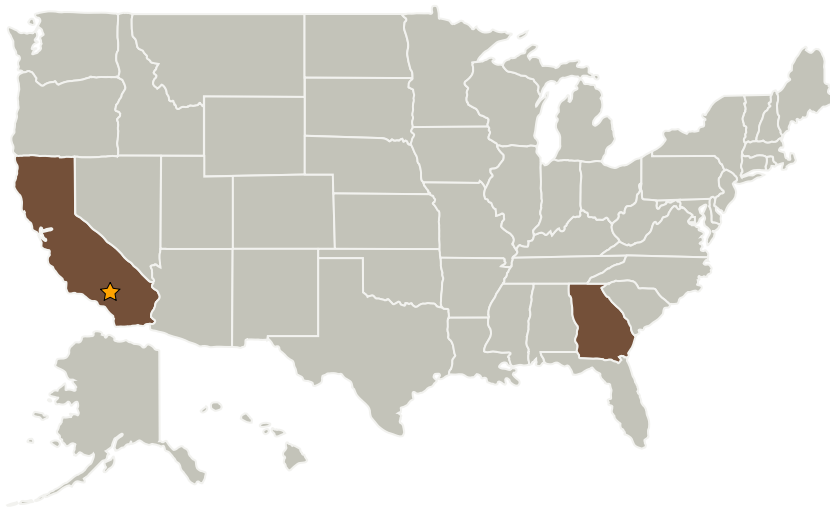
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increasing capacity and efficiency of the air transportation system by creating opportunities to develop airports in areas where they would have previously been unfeasible, and by enabling use of existing shorter runways at airports that are now underutilized. Also, these technologies have application to planetary aircraft for atmospheric science/exploration on planets where density and dynamic pressure are very low, such as Mars, Io, Titan, and Venus. The super-circulation technologies developed in this project for ESTOL applications may enable these aircraft to operate efficiently with greater payload capacity at lower dynamic pressures.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California
Aerotomy, Inc.	Supporting Organization	Industry	Lithia Springs, Georgia
Georgia Tech Research Corporation(GTRC)	Supporting Organization	Academia	Atlanta, Georgia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Jennifer H Cole

Principal Investigator:

Chris Gibson

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

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Primary U.S. Work Locations

California

Georgia